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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/802,780

Applicant(s)

SMALL, ROBERT J.

Examiner

Marianne L. Padgett

Art Unit

1792

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 9/7/2007, 7/30/2004 & 9/23/2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-46 is/are pending in the application.
- 4a) Of the above claim(s) 13-16 and 39-46 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12 and 17-38 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 7/30/4, 9/23/4.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

Art Unit: 1792

1. Applicant's election with traverse of the species (1) of hydroxyl amine & derivatives thereof (claims 1-12 & 17-38) in the reply filed on 9/7/2007 is acknowledged. The traversal is on the ground(s) that the different chemicals listed as species are not distinct species & there is no serious burden on the examiner. This is not found persuasive because applicant has not provided any evidence that the **distinct chemicals** of 1) hydroxyl amines; 2) periodic acid (claims 13-16); 3) hydrogen peroxide (claims 13-16); 4) reducing agents (claims 39-44, i.e. hydrazine); and 5) organometallics (claims 45-46), when employed in applicant's techniques for generating "clusters" in a liquid via electrical forces & "impacting" on a generic surface, cause the same unspecified modification (i.e. chemical reaction, or effect such as etching, coating, functionalization of surface, etc.) to that generic surface, hence have provided no evidence that these different chemicals, which one of ordinary skill in the art would not expect to have the same chemical reactions, are in fact equivalent to each other. Therefore, independent application of each of these different categories, i.e. species, of chemicals via the same techniques to generic substrates for unspecified surface modification (except in the case of the organometallics, which are required to deposit a metallic coating), clearly constitute different species of reactions, being performed with the generic deposition techniques, which would require different searches. With respect to burden, looking for all possible reactions of claimed chemical species for essentially all substrates would be a considerable burden, as each has different chemistries and may be used in a wide variety of different processes in order to produce a wide variety of different modifications. Applicant's arguments concerning dependent claim limitations is not convincing, as for example, the dependent claim sequences concerning organometallics, provides for sequential deposition techniques, such that those sequences limit the scope of the process, as well as clearly implying that different chemical effects for each sequential deposition do appear to be intended, thus support there being different species, not equivalent processes. To search for a specific technique of applying one chemical or type of chemical to it unknown surface in order to produce an unknown effect, is it difficult enough, as it does not clearly relate to any

Art Unit: 1792

particular classification, to do so for five separate chemical groupings, as required in the claims as **presently written**, is in an enormous burden.

The requirement is still deemed proper and is therefore made FINAL.

2. Claims 1-12 & 17-38 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The process as described in independent claim 1 is unclear, as it is uncertain exactly what in the first liquid, which comprises a hydroxylamine compound or derivatives thereof, is forming clusters or is in the clusters, and how those clusters, which as written might be in this liquid, are being impacted on the generic workpiece surface. The examiner notes that figures, such as figures 1 & 2, described in [0025+], [0044+], [0056+] & [0093+], etc., would appear to indicate that the claims are deficient, improperly or inaccurately describing the intended process, noting discussion of features, such as vacuum, or capillary tips, or cluster beam, etc.... in the specification. It is further uncertain exactly how some unspecified measure of electrical forces (electrical field (volt/cm or dynes/esu), current, electrical energy, electrical charge, etc.) is supposed to be compared to the nonelectrical feature of surface tension (contactile surface force of a liquid by which it tends to assume a spherical form & to present the least possible surface, as in formation of the meniscus or sphere, etc. (dynes or gm-cmr/sec²) of the "first liquid under conditions to prepare a first plurality of clusters", which presumably means just before the clusters are formed. For purposes of examination, it will be assumed that any application of electrical force which is sufficient to create a mist, or clusters of atoms from the liquid, or the like, from a bulk supply of the claimed liquid has "electrical forces higher than a surface tension of the first liquid...", i.e. that the electrical forces that caused the extraction of mist or clusters from the source liquid supplies more energy than the energy of surface tension of the liquid which holds the liquid in place in whatever configuration it is supplied, otherwise no mist or clusters would be formed.

Art Unit: 1792

Also, the body of independent claim 1 is not commensurate in scope with its preamble, which requires "modifying a workpiece surface", because while "clusters" that are derived from the first liquid are required to impact on a first portion of the surface, they are not actually required to have any effect on that surface, hence there is no necessary modification of the surface for claim 1 **as written**.

In claim 2 & its dependent claims 4 & 5, the limitation "the oxidizing agent" has no antecedent basis in the independent claim, hence it is unknown and unclear where in the process of the independent claim the oxidizing agent is being employed, with it being further unclear what relationship the aqueous hydroxylamines of these dependent claims have to the hydroxyl amines of the independent claim. While the examiner may suspect that applicant's intent was to further describe the hydroxylamines of the independent claim, the claim language employed by applicant is not consistent therewith, thus does not necessitate such a relationship, except in claim 6, where the nomenclature is provided with clear associations. Also note that since the material of the surface is anonymous, it is impossible to determine whether or not the claimed "oxidizing agent" of dependent claims 2+, would have any effect on the surface. It is further noted that while claim 2 recites "the oxidizing agent comprises at least one of aqueous hydroxylamine...", the dictionary definition of hydroxylamine (Hawley's Condensed Chemical Dictionary, 12th edition, p. 622), notes that hydroxylamine is used as a reducing agent or inorganic synthesis, and does not call it an oxidizing agent, thus either something else that has not been claimed is required to be present for the oxidizing agent to be an oxidant, or if the hydroxylamine is acting as an oxidizing agent, in order for the claims to have any clarity one must define what it is reacting with so that it causes oxidation, not reduction. In applicant's specification, hydroxylamine appears to be presented as a generic category with many species in paragraphs [0070-72], although it is not clear from applicant's disclosure what is, or if there is a dividing line between the generic of hydroxylamine & a derivative of hydroxylamine in the exemplary compounds. Note as evidenced by applicant's previous patent 6,635,186 B1, whose independent claims recite "an organic oxidant being hydroxylamine", that

Art Unit: 1792

such use of "hydroxylamine" must be considered a generic term having many species, since only functionalize versions with organic ligands of the basic hydroxylamine structure can properly be considered organic, since an amine with only hydrogen ligands is **not** organic, as it contains no hydrocarbon structure.

Also in claim 2, as phrased it is ambiguous whether "aqueous" applies only to "hydroxylamine", or to the substituted hydroxylamines also. Pending clarification either option will be considered. Claim 3 & its dependence also refer to "solvent", however the relationship between the aqueous requirement or option, & solvent is not clear, i.e. is the solvent necessarily water, partly water optionally water cobble or entirely different limitation?

In claim 10 applicants alternative choices include duplicate terms, since "perchloric acid" is claimed twice.

Use of relative terms that lack clear metes and bounds in the claims, or in a clear definition in the specification or cited relevant prior art, is vague and indefinite. In claims 11 & 17, the claim of "corrosion inhibitor" may be considered relative, since the material of the workpiece is undefined, the effect of the hydroxylamine applied to the unknown material, is also not known, hence there is no way to determine what may or may not be considered corrosion, especially considering that the environment under which corrosion is intended to be inhibited is also unknown. In other words, there is such a complete lack of context, that there's no way to determine what will or won't cause corrosion, such that one cannot possibly determine what will or won't inhibit corrosion. While claims 12 & 20-21 list specific materials that are said to be corrosion inhibitors, it remains unknown what material they are being applied to & under what conditions they will prevent what kind of corrosion in this unknown material, such that they provide more significance to the deposition of the specifically named benzotriazole (& derivatives) or dihydroxybenzene or trihydroxybenzene, than to the effect of these chemicals on the scope of all materials.

Art Unit: 1792

Claim 25 as written contains pressure requirements that appear to include contradictory requirements, thus is confusing, vague and indefinite in its scope. Specifically, the initial limitation of lines 1-3 requires that **both** the "impacting" of steps (c) & (f) occur while at gas pressures <500 torr with implications that the pressure applies to the entirety of each impacting step, however in lines 3-5, the further limitation of "once one of steps of (c) impacting and (f) impacting has been initiated..." appears to contradict the initial requirement allowing for (but not requiring) subjection to pressures >500 torr in contradiction of the preceding limitation that excluded those pressures. Clarification of intent & language is desirable.

In claim 31, it is unclear how a single deposition that need only include two different metals can deposit multiple different alloys all at the same time. Even considering the option of more than two different metals, all deposited on the "second portion of the surface", it is unclear how one might manage to make more than one alloy all from the same deposition step.

Claim 32 (hence its dependent claim 34) depends from claim 22, which is dependent from claim 17, thus this claim sequence has steps (a)-(f), hence there is no "(k) impacting", hence **as written** these claims make no sense. Note claim 32 also has issues analogous to claim 25. As written, only the limitations that apply solely to the impacting step of the independent claim are meaningful.

Similarly, **claims 33, 35-36 & 38** dependent from **claim 29**, which depends from claim 1, hence have steps (a)-(c) & (g)-(h), so also have no "(k) impacting", hence **as written** the claim limitations with respect to "(k) impacting" also make no sense, as only clusters in (?from?) the first liquid comprising hydroxylamine are claimed as impacted on first portions of the surface. Note "the third plurality of clusters" or "the... third cluster generation sites" have not been properly introduced into the claim process for these claims, thus are lacking in proper antecedent basis & any clear relationship to the process sequence. It appears that the examiner that applicant needs to carefully review the claim dependences in

Art Unit: 1792

order to clarify the sequences of steps & produce meaningful claim language. As written, only the limitations that apply solely to the impacting step of the independent claim are meaningful.

3.. Applicants PTO-1449 of 7/30/2004 & 9/23/2004 are made of record, however it is noted that for the Information Disclosure Statement of 9/23/2004 that the application information on the PTO 1449 did not match that of the cover sheet, being directed to SN 10/361,822 instead of the present application, and the statement of relevance in the IDS said that the references listed on the PTO-1449 were discussed in the specification, however no such discussion was found by the examiner, thus their relevance has not been properly discussed.

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In*

Art Unit: 1792

re Vogel, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer.

A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

5. Claims 1 & 28 are rejected under 35 U.S.C. 102(b) as being anticipated by Mahoney (6,033,484).

Mahoney (484) is teaching cleaning contaminated surfaces, especially semiconductor wafers & processing tools, but also optical substrates like mirrors, substrates in processing flat-panel displays, etc., using an energetic cluster beam, that is formed via electrostatically atomizing a conductive fluid supplied via a capillary tip, and which is sprayed onto the surface being clean, such that the impact energy of the clusters causes liftoff and removal of micron size & sub micron size particulates, organic films and metallic contaminants, without causing damage or sputtering of the impacted substrate surface, thus does not remove permanent features of the substrate or device being treated. Mahoney has teachings concerning adjusting the electrical potential of extraction electrodes in order to form the clusters, including the possibility of controlling the size of the clusters formed by varying the magnitude of the electric field. As an exemplary preferred conductive fluid, Mahoney discuss employing glycerol which may be mixed with water as a solvent, where this solvent mixture has been dubbed within electrolytic additive, such as ammonium acetate (salt), however is specifically stated that the useful conducted additives are not limited to the particularly mention volatile salts. See the abstract; figures, especially 1 & 5; col. 1, lines 9-65 (suggested uses); col. 4, line 42-col. 5, line 29; col. 7, lines 7-67+, especially 7-25 (suggested fluids) & 45-55; col. 8, lines 60-col. 9, line 9 & 26-65; col. 11, lines 11-15+; claims.

It is noted that while the claims require "first liquid comprising hydroxylamine or hydroxylamine derivative compound", Mahoney (484) does not discuss using any compounds employing the term

Art Unit: 1792

"hydroxylamine", however they specifically named electrolytic additive of ammonium acetate can be considered a hydroxylamine derivative compound as claimed, because ammonium acetate is an amine, as is hydroxyl amine, thus they both contain a structural radical of similar form, which is a definition of derivative (Hackh's Chemical Dictionary, p. 259). It is further noted that in Hawley's Condensed Chemical Dictionary, p. 622-623, that hydroxylamine & hydroxylammonium are frequently used interchangeably, thus further supporting calling ammonium acetate a derivative of hydroxylamine.

6. Claims 1-8 & 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Laroche et al. (6,251,482), in view of Mahoney(484).

Laroche et al. are teaching forming a mirror, where they discuss conventional techniques, which include a series of treatments of polishing, then sensitizing, rinsing, activating, then applying a silvering solution, followed by coating a protective coppering solution, where solutions & rinsing are aqueous and preformed via spraying. In discussion of the silvering step, they note a traditional silvering solution comprising a silver salt & a reducing agent, achieved by simultaneously spraying 2 solutions, with solution A containing ammoniacal silver nitrate & heptagluconic acid, and with solution B containing ammoniacal sodium hydroxide (i.e. the salt of ammonium hydroxide, which can be considered a hydroxylamine derivative & to consist essentially of itself and the solution solvent), noting that this solution B is free of metal. The coppering solution is also achieved by simultaneously spraying two solutions, with solution A containing ammonia, copper sulfate & hydroxylamine sulfate (i.e. a salt or derivative of hydroxylamine), & solution B containing citric acid & sulfuric acid. Laroche et al. note that the silver coating does not always adhere sufficiently to the substrate in this conventional process & they do not provide the details on the spraying techniques or the concentration of all the solution components (col. 1, lines 31-45 & col. 4, lines 58-col. 5, lines 30, especially lines 6-26). With respect concentrations, it would've been obvious to one of ordinary skill in the art to employ adequate amounts of each

Art Unit: 1792

component, such as the hydroxylamine or the ammonium hydroxide to achieve the claim process, which would have been reasonably expected to be within the broad ranges claimed.

As noted in discussion in section 2 above, the oxidizing agent" of claim 1 has unclear relationship to the process of independent claim 1, however in order to be able to consider the claims with respect to prior art, if one assumes the most logical possible meaning that the "hydroxylamine or... compound" of the first liquid is being further defined to comprise "at least one of aqueous hydroxylamine or a hydroxylamine substituted...", such claim limitations may be considered. The unknown oxidizing agent used or not used at an unknown time to create no necessary effect cannot be effectively considered in the context of the claims as written.

Mahoney (484) discussed above, provides teachings on a spraying techniques useful for cleaning contaminated surfaces, inclusive of processes for making optics such as mirrors (col. 1, lines 42- 55, especially 44), where Mahoney considers their spraying techniques to be an improved means of removing contaminants and treating a substrate surface, as the electrostatic cluster beam effectively treats all surface recesses & decreases the time necessary to perform such steps (col. 4, lines 30-col. 5, lines 27). As discussed in col. 7, the demineralized water spray rinsings would have been expected to be effectively replaced by Mahoney's specific cleaning/rinsing solutions for the specific advantages taught therefore, while the requirements for a solution that can be used to effectively form a cluster beam is via Mahoney's techniques require use of a polar solvent with electrolytic additives, which is consistent with the spray solutions of Laroche et al.'s discussed conventional techniques. Hence, it would've been obvious to one of ordinary skill in the art to employ the specific electrostatic cluster spray technique of Mahoney for the generic spray technique of Laroche et al., as all the solutions would have been expected to be effectively applied, with additional advantages of more effective surface coverage & shorter treatment times expected due to superior application. Note due to analogous ammonia, amine & aqueous chemistry of the two references, the preferred solvent of glycerol (a triol or trihydric alcohol) employed by Mahoney,

Art Unit: 1792

would also have been expected to be an effective vehicle to employ in solvent mixtures for spraying in Laroche et al., as it would've been expected to be similarly effective in both the rinsing, as well as the chemical delivery steps, which are all performed by spraying.

7. Claims 1-8 & 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mukerji (5,442,240), in view of Mahoney(484).

Mukerji et al. (240) teach pretreating the surface of a semiconductor die, which includes polyimide layer 18 & pads 11 for interconnects 14, with an organic base solution exemplified by a 20 % organic base solution of hydroxylamine, in order to generate functional groups on the surface of the polyimide layer, in order to create covalent bonding & improved adherence when the semiconductor device is attached to a substrate via an epoxy encapsulate (16). Note that the amino-ester & amide functional groups formed thereby both contained oxygen, hence one might consider an oxidizing agent to have been present or the hydroxylamine solution to have been an oxidizing agent due to the formation of oxygen functional groups. The hydroxylamine solution may be applied to the semiconductor device via immersion or spraying, and the hydroxylamine solution may also include a reagents, such as aminoethoxy ethane alcohol, amines or imidazole, dissolved in a solvent such as N-methyl pyrrolidione, or analogous reagents & solvents (abstract; figure; col. 1, lines 10-26, col. 2, lines 4-40 for the general set up & lines 67-col. 3, lines 45, especially 1-6 & 34-41; col. 4, lines 5-10).

Mukerji et al. (240) does not provide any details on any particular spraying techniques, and their teachings on solution concentration ranging from 10-20 %, fail to provide a basis for the calculation of the percentages, or exactly what those percentages represent. Mukherjee et al. also differ from the present claimed limitations by not discussing whether or not there 20 % organic base solution may be aqueous, i.e. include water, or not. It would've been obvious to one of ordinary skill of the art that they taught solution concentration percentages are either volume, weight, or moles percentages as these are the typical basis used for calculating percentages, thus there would have been a reasonable expectation that

Art Unit: 1792

the percentages of hydroxylamine or derivatives thereof employed in the process of the primary reference would have been with an the claimed percentages among especially considering a teaching of both a range of concentrations & a range of possible reagents for the hydroxylamine solution indicates an expected degree of routine experimentation to optimize the particular solution for the specific process. With respect to a possible presence of water, all the solvent & reagents discussed by Mukerji et al. are miscible with water, hence it would've been further obvious to one of ordinary skill in the art to employ aqueous organic base solutions, dependent on optimum viscosity for spraying techniques, as well as adjustment solubility or reaction conditions.

With respect to particular spraying techniques, any spraying technique which would have been expected to be effective for both the solution being applied & for distribution of that solution on to the substrate being treated, would have been expected to be effective, hence the electrostatic cluster spraying techniques of Mahoney would have been expected to be effective, as it is employed for analogous solutions, also intended to be sprayed on semiconductor devices, and it would have been expected to be additionally advantageous as it is taught for application to surfaces with micro features, as would have been expected to be present in Mukerji et al.'s taught semiconductor devices. Also, the more effective the surface treatment is at treating all parts of the surface, the more effective it would have been expected to be in improving the adhesion as desired. Also note the cleaning abilities of the particular spray techniques would have been expected to be cumulative to the approved adhesion of the chemical treatment, as it is all that well known in the coating arts that clean surfaces generally have improved adhesion as compared to contaminated surfaces. Also as Mahoney shows use of an analogous organic solvent, which may or may not be used with water, this further supports the obviousness of the use of aqueous organic solutions in the applied combination.

8. Claims 1-8 & 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hempel (5,597,443), in view of Mahoney(484), or vice versa.

Art Unit: 1792

Hempel et al. teach processing of a semiconductor wafer, where after a chemical mechanical polishing (CMP) process, the wafer is claimed at a cleansing station, that employs both spraying a jet of water & a spray dispensing to for providing a mixed aqueous solution of NH_4OH to the semiconductor wafer for cleaning thereof, including the removal of particles from the CMP process (abstract; figures 1 & 3; col. 4, lines 45-col. 5, lines 30). While Hempel et al. teaches a specific spray deposition techniques for their cleaning process, Mahoney who was also teaching a cleaning techniques applicable to like situations, teaches that the electrostatic cluster spray techniques employed by Mahoney is particularly advantageous for removal of particulate contaminants, as well as being particularly advantageous for use in the processing of semiconductor wafers due to the effects of the clusters interaction with the surface being cleaned/impinge upon via sprayed solution, thus one of ordinary skill of the art would have expected the Mahoney electrostatic spray techniques to also produce superior cleaning & particle removal affects when using the aqueous NH_4OH solution of Hempel et al. in the treatment sequence therein, as the solution is also suitably ionic, hence electrolytic, or alternately for the NH_4OH to be an effective alternative to the ammonium acetate salt both for imparting the required conductivity to the solution to enable the electrostatic spraying techniques for cleaning as discussed in Mahoney, where that cleaning is employed after CMP operations, where further cleaning & neutralization chemical affects our required, as discussed in the Hempel et al. process.

9. Claims 1-3, 7-11, 17-19, 21- 28, 32 & 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Daviot et al. (7,235,188 B2), in view of Mahoney(484).

Daviot et al. (188) teach treatments of semiconductor devices, particularly for cleaning etch residues, that employ dilute aqueous solutions of phosphoric acid in combination with alkaline compounds and/or acids, where those alkaline compounds may be quaternary ammonium hydroxide, hydroxylamine derivatives (typically supplied as 50% solution in water & used in amounts from about 0.3-1 % by weight). Additional acid compounds that may be present include nitric acid, periodic acid,

Art Unit: 1792

sulfuric acid or various organic acids. Other taught components that may be employed include polar organic solvents, such as various glycols or N-methyl pyrrolidone, and chelating agents, such as di- or multi-hydroxybenzene compounds, with mention of catechol or resorcinol, which according to the chemical dictionary are both alternative names for dihydroxybenzene, and according to applicant's claim 21 is a corrosion inhibitor (any conditions & applied to any material). In Daviot et al. for the compositional teachings see the abstract; col. 1, lines 15-20; the summary, especially col. 1, lines 30-60 & 66-col. 2, lines 12, 20-23 & 35-39; col.s 3-4, especially col. 3, lines 15-34, 41-58 & 65-col. 4, lines 13, with compositional embodiments starting online 18; col. 5, lines 37-56; col. 6-7 for alkaline compounds, especially col. 6, lines 15-63, noting for the quaternary ammonium compounds alternative counter ions besides hydroxide counter ion, include organic carboxylates; col. 8, lines 13-25 & 55-col. 9, lines 15 & 35-38.

Daviot et al. (188) teach cleaning substrates during semiconductor device fabrication with their dilute aqueous solutions where the substrates have varying aspect ratios & metal structures, as well as various metal nitrides &/or oxides (col. 10, lines 43-56), where the dilute aqueous solutions may be applied either via a version and a bath or by spray directed at the substrate (col. 10, lines 59-64). It is further taught that a rinse step typically may follow application of the dilute aqueous solution of phosphoric acid, where the rinse solution may be rinse materials as described in USPN 5,981,454 (Small (454)), which is incorporated by reference in Daviot of et al. (188). Exemplary spray applications are further mentioned with respect to examples 3-5 (col. 12, lines 50-col. 13, lines 10). Relevant teaching in Small ((454): abstract; col. 2, lines 37-53; col. 3, lines 55-67; col. 4, lines 36-49 & 62-col. 5, lines 14; col. 7, lines 32-col. 8, lines 40; table III & lines 30-31 & 45-55 in col. 9; & col. 10, example 3, with lines 45-46 noting that hydroxylamine or its salt in acetic solution is a mild oxidizing agent) include a post clean treatment composition that is in aqueous solution that may contain di- or tri- functional organic acids &

Art Unit: 1792

buffering amounts of ammonium hydroxide, hydroxylamine or salt thereof, as well as chelating agents (catechol/dihydroxybenzene).

While Daviot et al. (188) teach application via spraying, they do not require any specific spraying techniques or parameters therefore, however Mahoney (484) teaches a particular spray technique of electrostatic cluster spraying taught to be advantageous for cleaning & rinsing procedures due to the action of the large ionized clusters that are impinged on the substrate being cleaned, hence it would've been obvious to one of ordinary skill in the art to use the compositions as taught by Daviot et al., including those incorporated from Small (454), in the spraying apparatus & use thereof for cleaning as taught by Mahoney, with the expectation that the compositions of Daviot et al. would have been effective therein, because they are also ionic solutions that would have been expected to have sufficient conductivity to be as effectively electrostatically treated; the compositions employed two references have overlapping components (Mahoney suggested ammonium acetate salt isn't ammonium compound with a carboxyl might counter ion encompassed by the disclosure of Daviot et al. & glyceryl is a multifunctional organic solvent, and both may be aqueous); & both references are directed to cleaning the same types of semiconductor structures, with Mahoney providing particular reasons why the electrostatics cluster spraying beam is particularly advantageous for the structures. Further note that the teachings of Mahoney concerning adjustment of parameter processes (electrical potential, flow rate, fluid conductivity, etc.) in order to control cluster size & effects of the cleaning process (col. 7, lines 35-col. 8, 59) would have been expected to be applicable & necessary to apply, with routine experimentation to determine optimal effective parameters for different solutions & different substrates, material &/or structure, being treated. It is further noted by the examiner that the flow rate of the conductive fluid being extracted by the extractor electrode due to the electrical potential will be inherently affected by the degree of vacuum present in vacuum chamber 27, as is consistent with discussion on col. 6 of Mahoney, particularly lines 25-66.

Art Unit: 1792

Note with respect to claim limitations of impacting clusters of different compositions, these compositions are "comprising", hence not mutually exclusive of each other & the requirements concerning impacting on first portion, or second portion, etc., do not exclude the first portion & the second portion being identical or overlapping places on the surface. Further note that specific variation of parameters, when the effect of the impact is unknown, the material being impacted is unknown, etc., provides little context for such variation of parameters to have patentable significance or clear meaning with respect to effect in a process, especially considering that change of composition for the purpose of effecting a different stage in the cleaning process, such as rinsing suggested in Daviot et al., would have been expected to involve optimization of the parameters for electrostatic cluster spraying in order to effect the specific desired results, thus would have been expected to encompass variations in parameters employed, such as kinetic energy or pressure, or any of the parameters that may be employed to effect optimization of the clusters spraying techniques.

10. Claims 12 & 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Daviot et al. (7,235,188 B2), in view of Mahoney(484), as applied above to claims 1-3, 7-11, 17-19, 21- 28, 32 & 34 and further in view of Small et al. (6,313,039 B1).

A combination of Daviot et al. (incorporates Small (454)) & Mahoney (484) does not teach the particular corrosion inhibitor of benzotriazole, however Small et al. (039) who is teaching compositions & series of compositional applications inclusive of post clean treatment, analogous to those of Daviot et al. as discussed above, further discloses that in acid solutions, particularly aggressive ones, an inhibitor, i.e. benzotriazole (BTA), is usually needed to control isotropic etching effects from the chemistry (col. 3, lines 58-65 & col. 9, lines 1-15), hence it would've been obvious to one of ordinary skill in the art to employ such corrosion inhibitors in the above combination, because the compositions disclosed therein include acidic compositions which are to be applied to semiconductor device surfaces or precursors thereof, which include metal structures that are desired to be maintained, such that the advantages of

• Art Unit: 1792

inhibiting corrosion pair of with such no corrosion inhibitors would have been an obvious variation on the taught compositions, whether applied in the initial cleaning composition which is specifically acidic or sequential rinsing which also may be acidic. Also see the abstract; col. 3, lines 30-40+; col. 4, lines 55-col. 5, lines 67+; col. 6, lines 65-col. 7, lines 37 & 62-col. 8, lines 19 & 30-57 & 66-col. 9, lines 22 & 51-67; col. 10, lines 60-col. 11, lines 55, for compositions related to Daviot et al. & Small (454).

11. Claims 1-3, 7-8, 11, 17-19, 21- 28, 32 & 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schifko et al. (6,277,747 B1), in view of Mahoney(484).

Analogous to Daviot et al. or Hempel, discussed above Schifko et al. (747) performs a cleaning operation on a semiconductor substrate during manufacture, where in this case it is after a reactive ion etching technique, and it is taught to spray a solution based on hydroxylamine, such as one suggested to be commercially sold by EKC, which removes etch residue & contains water, alkanolamine, catechol & hydroxylamine (abstract & col. 2, lines 46-col. 3, lines 5). Again the primary reference does not specify any particular spraying techniques, parameters or procedure, hence it would've been obvious for reasons as discussed above to employ the advantageous procedure of Mahoney for the generic spraying techniques of Schifko et al., where it is further noted that the EKC solutions proposed for use by Schifko have the same basic components as those proposed for use in Daviot et al. (incorporates Small (454), assignee EKC technologies, Inc.) thus the same basic arguments & reasons would apply.

12. Claims 9-12, 17-27, 32 & 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hempel (5,597,443) combined with Mahoney(484), as applied above to claims 1-8 & 28, and further in view of Small et al. (6,313,039 B1).

Claims 9-10, 12 & 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schifko et al. (747) combined with Mahoney(484), as applied above to claims 1-3, 7-8, 11, 17-19, 21- 28, 32 & 34, and further in view of Small et al. (6,313,039 B1).

Art Unit: 1792

The combination of Hempel or Schifko et al. & Mahoney do not discuss addition of various claimed acid or all the corrosion inhibitors to solutions sprayed onto semiconductor devices during manufacture, however these combination shows the conventional treatment of such semiconductor wafers in a series of processes encompassing CMP or reactive ion etching followed by cleaning with aqueous NH_4OH , or the solution containing water, alkanolamine, catechol & hydroxylamine, respectively in each primary reference, while Small et al. (039) discussed above provides alternative cleaning & rinse compositions effective for cleaning after CMP, which like Hempel also control the pH & provide highly ionic solutions which would have been expected to be effective when employing the advantageous electrostatic cluster spraying technique of Mahoney, thus for reasons analogous to those discussed above these alternative solutions would have been expected to provide predictable and effective results when employed using the spraying apparatus & techniques of Mahoney, motivated by Hempel to deploy the solutions via spraying if due to their increased effectiveness for cleaning. With respect to Schifko et al, the teachings therein suggest using the same basic compositions as employed by Small et al. (039), also used for cleaning residue from analogous processing, hence the more detailed variations as proposed in the ternary reference would have been expected to be obvious variations applicable to the more general solution as described in Schifko et al, with the expectation of predictable is a results analogous to those described in Small et al. (039) due to the similarity of residues being removed, the suggestion of spraying like solutions in Schifko et al, with Mahoney et al. suggesting the superior effectiveness of the electrostatic cluster beam spraying techniques.

13. Claims 29-31, 33 & 35-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hempel (5,597,443) combined with Mahoney(484), as applied above to claims 1-12, 17-28, 32 & 34 and further in view of Yamanobe et al. (2002/0132041 A1).

Art Unit: 1792

Claims 29-31, 33 & 35-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schifko et al. (747) combined with Mahoney(484), as applied above to claims 1-3, 7-12, 17- 28, 32 & 34, and further in view of Yamanobe et al. (2002/0132041 A1).

Claims 29-31, 33 & 35-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Daviot et al. (7,235,188 B2), in view of Mahoney(484), as applied above to claims 1-3, 7-12, 17- 28, 32 & 34, and further in view of Yamanobe et al. (2002/0132041 A1).

These combinations, which are directed primarily to cleaning & treating processes during a semiconductor device formation process, do not address formation of metal features on the substrate surface, although such features are mentioned as potentially present on the substrate surface & would have been expected to be applied in further processing steps for typical semiconductor device formation. Yamanobe et al. (2002/0132041 A1), who teaches a process for making a particular semiconductor structure, i.e. an electron emitting device particularly used in display apparatus (note Mahoney suggested use in flat-panel display manufacturing to lower-cost & uphold reliability; col. 1, lines 45-48), particularly teach electrostatic spraying of an atomized solution of organometallic through a nozzle in order to deposit a conductive element using electrical potentials ([0093]; [0158-0166]; [0421] & [0615]) hence it would've been obvious to one of ordinary skill in the art to employ such electrostatic spraying processes in semiconductor device formation when previous or subsequent formation of conductive layers or configurations are required, including consideration of the more detailed discussion of the electrostatic spraying process in Mahoney, including noting that Mahoney supplies alternative means for directing the electrostatic spraying (col. 11, lines 11-30), such that one of ordinary skill in the art would have been well aware that they are not limited to directing the spraying using configurations of electrodes already present on the substrate as in the specific deposition techniques of the ternary reference. Furthermore, dependent on the particular device, hence designed or pattern of deposition desired or already present structural formations on the device, the teachings concerning advantages of cluster beam electrostatic spraying as

Art Unit: 1792

provided by Mahoney's technique would have been expected to be relevant in enabling filling or deposition with respect to nonplanar structures, such as vias, due to the taught mechanisms by which the cluster beam spreads on the surface & effects recesses, thus providing predictable effects when employed for deposition as well as cleaning. Again, with the employment of a different solution as required for deposition of a conductive layer, as opposed to surface treatment for cleaning, electrostatic static spray parameters would have been expected to be optimized for the particular deposition compositions & substrate surfaces being treated.

14. Other art of interest includes: Perng et al. (7,122,484 B2), which is not prior art, however is of interest for claims/teachings directed to treating substrates with liquid solutions that may be aqueous & have additives such as hydroxylamine & acids like H_2SO_4 , where that liquid solution may be sprayed.

Galbo et al. (6,392,041 B1), Gotta et al. (4,003,761) & Chowdhury (2004/0110387 A1) are further of interest for employing spraying techniques that use solutions containing hydroxylamines, where it is noted that in Galbo et al. the ink therein may be sprayed using electrostatic techniques, while the other two references include "corrosion inhibitors" in their solutions. Nesteruk (3,645,778) is of interest for electrostatic spraying solutions of organometallic compounds.

Other patents to Small et al. (6,251,150 B1 & 6,498,131 B1), cited by applicants in their IDS, are of interest for relevant aqueous compositions containing hydroxylamines, particular the latter relating to post CMP cleaning, and are considered redundant &/or cumulative in view of the above rejections.

15. Claims 1-8, 11, 17-19, 22-27, 32 & 34 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-24 of U.S. Patent No. 7,051,742 B2 (Lee et al.) in view of Mahoney and Schifko et al. (747) as applied above.

Claims 1-12, 17-27, 32 & 34 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-24 of U.S. Patent No. 7,051,742 B2 (Lee et al.) in view of Mahoney and Schifko et al. (747), further in view of Small et al. (039) as applied above.

Art Unit: 1792

Claims 1-10 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-40 of U.S. Patent No. 6,546,939 B1 (Small et al.) in view of Mahoney and Schifko et al. (747) as applied above.

Claims 1-12, 17-27, 32 & 34 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-40 of U.S. Patent No. 6,546,939 B1 (Small et al.) in view of Mahoney and Schifko et al. (747), further in view of Small et al. (039), as applied above.

Claims 1-12, 17-27, 32 & 34 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 20-30 of copending Application No. 11/633,459 in view of Mahoney and Schifko et al. (747), further in view of Small et al. (039), as applied above. This (11/633459) is a provisional obviousness-type double patenting rejection.

The above patents Small et al. (939) & Lee et al. (742), as well as the (459) application, all have cleaning processes, directed to cleaning resist & etching residues, or chemical residues, using aqueous hydroxylamine solutions, with various variations on additional components such as claimed acids, corrosion inhibitors/chelating agents, organic solvents, etc., however these variations were shown to be obvious at as discussed above, particularly view of Small et al. (039) & R. analogously applicable here.

These cleaning processes of the patents & copending application, differ from the claimed process (which may or may not be cleaning, as no use our effect is specified in the present claims) in that the solutions when applied have no electrical forces applied thereto used in forming clusters that are impacted on the substrate during the process, however as discussed above Mahoney et al. provides teachings concerning an electrostatic cluster spraying process that may be used for cleaning purposes analogous to these patents & copending application, where Schifko et al. was seen above to use an analogous aqueous hydroxylamine cleaning solution sprayed on relevant substrates, where analogous to the above discussion Schifko et al. provides motivation to apply cleaning solutions as in the patented & copending application claims via spraying, where Mahoney et al. provides advantages for using their particular spraying

Art Unit: 1792

techniques for cleaning, such that the advantages discussed therein would have been expected to reasonably be applicable to the cleaning solutions of this patented & copending application claims, for reasons as discussed above.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Marianne L. Padgett whose telephone number is (571) 272-1425. The examiner can normally be reached on M-F from about 8:30 a.m. to 4:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks, can be reached at (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.


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MLP/dictation software

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